REMARKS/ARGUMENTS

Claims 1 and 3-5 stand finally rejected under 35 U.S.C. 102(e) as being unpatentable over Stokes (U.S. 6,968,234) in view of Gagliardi (U.S. 3,547,688). For the reasons set forth hereinafter, and the Declaration of Dr. Tsutomu Furuzono submitted herewith, it is requested that the Examiner reconsider and withdraw this rejection.

Claims 1 and 3-5 all recite a titanium oxide complex, comprising a polymer-based material having an active group; and titanium oxide having a reactive functional group which is capable of reacting with the active group, wherein the active group and the reactive functional group are directly bonded to each other based on a chemical bond, and the reactive functional group is an amino group, and the chemical bond is an amido bond.

Stokes teaches covalent bonds of biologically active agents to a base polymer. Examples of the biologically active agents of Stokes include microbial peptide agents, detergents, non-steroidal anti-inflammatory drugs, cations, amine-containing organosilicones, diphosphonates, fatty acids and fatty acid salts, but do not include titanium oxide. Stokes does not disclose titanium oxide having an amino group serving as a reactive functional group. The Examiner admits that Stokes is silent as to the amido groups complexed with titanium oxide.

The Examiner contends that since Gagliardi teaches that it has been known to incorporate complex salts of silver with amido groups into plastic medical devices for antibacterial effects, it would have been obvious to incorporate silver amido complex salts into the medical device of Stokes in order to obtain antimicrobial benefits. The Examiner argues that silver amido salts would be expected to complex with titanium oxide and function as claimed. However, even if

the complex salts of silver with amido groups are incorporated instead of the biologically active agents of the casing of the medical device of Stokes, the absence of titanium oxide makes it impossible to obtain a titanium oxide complex in which titanium oxide and a polymer-based material are bonded to each other based on an amide bond, as recited in claim 1 and dependent claims 3-5.

Further, Stokes states: "The use of silver ion has been promoted as bactericidal. Silver received a bad name because it apparently also inhibits the healing process, resulting in blood leakage around treated valve sewing rings, for example" (see col. 1, lines 47 to 50). Accordingly, the invention of Stokes is focused mainly on using the biologically active agents instead of chemical substances such as silver in order to prevent or reduce infections centered at an implanted medical device. Therefore, the application of the complex salts of silver with amido groups of Gagliardi to the Stokes device is not warranted, because it is against the spirit and teachings of the invention of Stokes.

It is submitted, therefore, that the novel recitations of claims 1 and 3-5 clearly are not obvious in view of the teachings of Stokes and Gagliardi.

Claims 6 and 9 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Stokes in view of Lomas (U.S. 6,716,908) and further in view of Furuya et al. (U.S. 6,048,910). The Examiner recognizes that, while Stokes teaches covalent bonding, it does not specifically teach hydroxyl groups or an alkoxysilyl functional group as claimed. Further, the Examiner states that Lomas teaches that it is well known in the art to provide alkoxysilyl functionalized silicone polymers in personal care products, but that Lomas does not teach hydroxyl functional groups. Furuya et al. has been cited by the Examiner for its teaching that a coating can be rendered hydrophilic by adding particulate photocatalysts, typically titanium oxide.

Claim 6 and dependent claim 9 recite a titanium oxide complex, comprising a hydroxyl group contained in titanium oxide; and a polymer-based material having a functional group which is capable of chemically bonding to the hydroxyl group, wherein the hydroxyl group and the polymer-based material are directly bonded to each other based on a chemical bond, and the functional group is an alkoxysilyl group. It is submitted that these novel recitations are not rendered obvious by the combined teachings of Stokes, Lomas and Furuya et al.

The Examiner contends that it would have been obvious to incorporate alkoxysilyl functionalized silicone into the medical device of Stokes in expectation of effects such as durability and thermal stability and to incorporate a hydroxyl titanium oxide complex into the medical device of Stokes in expectation of the antibacterial properties and self-cleaning functions inherent in the titanium oxide.

Stokes, however, states: "The use of silver ion has been promoted as bactericidal. Silver received a bad name because it apparently also inhibits the healing process, resulting in blood leakage around treated valve sewing rings, for example. No effective long-term means of preventing or reducing device centered infection has yet been described. Accordingly, one possible object of the invention is to prevent or reduce infections centered at an implanted medical device. This and other objects are accomplished by providing in an improved implantable medical device" (see Col. 1, lines 47 to 60). Moreover, the invention of Stokes is focused mainly on using the biologically active agents instead of chemical substances such as silver in order to prevent or reduce infections centered at an implanted medical device. Therefore, the incorporation of the hydroxyl titanium oxide complex, which is a chemical substance, into the medical device of Stokes is not warranted, because it is against the teachings and spirit of the invention of Stokes.

Accordingly, the novel recitations of claims 6 and 9 are not rendered obvious by the teachings of Stokes, Lomas and Furuya et al.

Claim 8 stands rejected under 35 U.S.C. 103(a) as being unpatentable over Stokes in view of Lomas and further in view of Furuya et al., as applied to claim 6, and still further in view of JP 402109570A.

Claim 8 is dependent on claim 6 and further recites that the polymer-based material is silkfibroin. Since JP '570A teaches that silkfibroin is a material that can be employed for various medical materials, the Examiner concludes that it would have been obvious to one of ordinary skill in the art to use silkfibroin as the polymer-based material in a titanium oxide complex of claim 6.

It is submitted that claim 8 is allowable over the teachings of Stokes, Lomas and Furuya et al. for the reasons set forth herein with respect to the rejection of claim 6. Even though JP '570A teaches the use of silkfibroin as a material that can be employed for various medical materials, this reference fails to supply the deficiencies of the other references with respect to the novel recitations in claim 8, which is dependent on claim 6.

Claims 1, 4 and 5 stand rejected 35 U.S.C. 103(a) as being unpatentable over JP 2002331028 in view of Gagliardi. The Examiner states that it would have been obvious to one of ordinary skill in the art to incorporate silver amido salts (which would be expected to complex with titanium oxide and function as claimed) into the composition of JP'028 in order to obtain antimicrobial benefits in the medical device. It is requested that the Examiner reconsider and withdraw this rejection in view of the arguments submitted hereinafter.

The Examiner contends that JP '028 teaches a medical device made from an elastomer (polymer) having a photocatalyst layer comprising titanium oxide, the surface being treated with

acid and being considered to be bonded directly to the titanium oxide. However, JP '028 discloses a medical tube comprising an elastomer tube material whose surface is treated with acid wherein a surface of the resulting tube is coated with a photocatalyst layer including titanium oxide particles each having an antibacterial metal on its surface (see claim 9, for example). Further, JP '028 describes a dip coating treatment or a spraying treatment being adopted in coating the tube material with the photocatalyst layer including titanium oxide (see paragraph [0022]). In case of adopting the dip coating treatment, the tube material and the photocatalyst layer including titanium oxide are merely physically absorbed to each other, and hence the tube material and the photocatalyst layer are not bonded to each other based on a chemical bond. Also, the surface of the tube material is treated with acid, but this treatment is to realize firmer physical absorption by making the surface of the tube rough with acid, so that this treatment is not to create a chemical bond.

Accordingly, JP '028 neither discloses nor suggests Applicant's novel concept of producing a titanium oxide complex, including a polymer-based material having an active group and titanium oxide having a reactive functional group capable of reacting with the active group, wherein the active group and the reactive functional group arc directly bonded to each other based on an amide bond, let alone the concept of producing a titanium oxide complex with use of a chemical bond.

The Examiner contends that, in view of Gagliardi, it would have been obvious to incorporate complex salts of silver with amido groups into the medical device of JP '028 in order to obtain antimicrobial benefits. However, even if the complex salts of silver with amido groups are incorporated into the tube of JP '028 , the novel recitations of claims 1, 4 and 5, are not rendered obvious because neither JP '028 nor Gagliardi discloses the novel concept of

producing a titanium oxide complex, including a polymer-based material having an active group and titanium oxide having a reactive functional group capable of reacting with the active group, wherein the active group and the reactive functional group are directed bonded to each other based on an amide bond. Therefore, the novel recitations of claims 1, 4 and 5 clearly differentiate from the combined teachings of JP '028 and Gagliardi.

The Declaration of Dr. Tsutomu Furuzono submitted herewith clearly demonstrates the advantages of the titanium oxide complex of the present invention wherein the high adhesiveness to tissues results from the amino group on the surface of the titanium oxide, as evidenced by Fig. 1 in the Declaration. This Declaration demonstrates that the number of adhering cells increases as the number of an amino group introduced to the titanium oxide increases. This significant feature of the titanium oxide complex of the present invention clearly cannot be obtained by the compositions and complexes disclosed in the references cited by the Examiner for the reason that none of them, taken individually or in combination discloses or suggests a titanium oxide complex obtained through an amide bond between titanium oxide having an amino group and a polymer-based material having a reactive functional group.

It is apparent that none of the cited references provides an incentive to cause an amino group contained in a titanium oxide and a reactive functional group contained in a polymer-based material to be bonded to each other based on an amide bond. It would not have been possible, therefore, for a person skilled in the art, to conceive of Applicants' novel titanium oxide complex recited in the claims of the present application based on the teachings of the cited references.

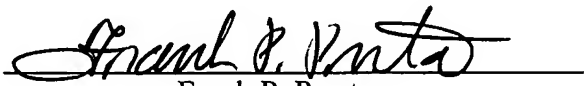
With respect to claim 6 and the claims depending therefrom, the inventors of the present invention have found that a titanium oxide complex can be produced by using two kinds of hydroxyl groups on crystal faces occupying a largest area on the surface of TiO_2, i.e., an anatase-

type (001) face and a rutile-type (110) face (a terminal OH group combined with Ti^{4+}, and a bridge OH group combined with two Ti^{4+}s), and thus conceived the invention according to claim 6 of the present invention. This invention makes it unnecessary to perform a chemical pretreatment on titanium oxide (a treatment to introduce an active group), which brings about the effect of reducing a possibility that the active group remaining on the surface of the titanium oxide impairs properties of titanium oxide. This is a significant and advantageous effect brought about by the invention according to claim 6 of the present application which would not be within the knowledge of one skilled in the art based on the teachings of the cited references.

In view of the above remarks, and the Declaration of Dr. Tsutomu Furuzono filed herewith, it is submitted that claims 1, 3-6, 8 and 9 are clearly allowable over the teachings of the cited references. It is requested, therefore, that the Examiner reconsider and withdraw these rejections, and allow all of the claims in the present application as set forth herein.

Respectfully submitted,

NIXON & VANDERHYE P.C.

By: 

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